What is claimed is:

1. A method for manufacturing a semiconductor device, said method comprising:

a recess forming step of forming recesses in a substrate proper that has semiconductor circuits and electrodes formed on one surface thereof;

an embedded electrode forming step of filling a conductive material into said recesses to form embedded electrodes that constitute penetration electrodes;

a connection step of electrically connecting said electrodes on said substrate proper and said embedded electrodes with one another;

an organic film forming step of forming an organic film on the one surface of said substrate proper;

an adhesion step of adhering a support member, which supplements the mechanical rigidity of said substrate proper, to said organic film;

a semiconductor substrate forming step of removing a rear side of said substrate proper opposite to said one surface thereof until a bottom of each of said embedded electrodes is exposed and protruded, thereby to form said penetration electrodes and a thinned semiconductor substrate;

a film forming step of forming plating films on surfaces of the protruded portions of said embedded electrodes; and

a removal step of removing said support member and said organic film from said semiconductor substrate;

wherein said organic film has an adhesive property and chemical resistance to chemical substances used in respective process steps after said adhesion step, said organic film being at least dissolved in or peeled off from a chemical substance used in said removal step.

2. The method for manufacturing a semiconductor device according to claim 1, said method further comprising a step of forming a binding layer

between said organic film and said support member.

3. The method for manufacturing a semiconductor device according to claim 1, wherein said support member and said organic film are removed from said semiconductor substrate in one and the same process step.

4. The method for manufacturing a semiconductor device according to claim 1, said method further comprising a step of forming protrusion electrodes on a principal plane of said semiconductor device after said connection step.

5. The method for manufacturing a semiconductor device according to claim 1, wherein said film forming step is performed through electroless plating which is a liquid-phase selective growth process or through a vapor-phase selective growth process.

6. The method for manufacturing a semiconductor device according to claim 1, wherein said organic film comprises an organic insulation film formed of a photoresist.

7. The method for manufacturing a semiconductor device according to claim 1, wherein said organic film comprises an organic conductive film formed of a conductive paste, and said film forming step is performed through electrolytic plating or electroless plating while keeping said penetration electrodes at the same potential.

8. The method for manufacturing a semiconductor device according to claim 1, wherein said organic film is formed by means of a spin coating method.

9. The method for manufacturing a semiconductor device according to claim 2, wherein

said support member is formed of a material through which ultraviolet rays are able to pass, and said binding layer is formed of a material which loses its adhesion when irradiated by ultraviolet rays; and

in said removal step, said ultraviolet rays are irradiated to said binding layer from a side of said support member, and said support member is peeled off from said semiconductor substrate after at least the peripheral portions of

said organic film are dissolved and removed up to a depth reaching said binding layer by a chemical liquid that constitutes said chemical substance.

10. The method for manufacturing a semiconductor device according to claim 9, wherein said support member comprises quartz glass.